social communication (Hutinger et al, 1998). Care must be taken with very young children (i.e. less than four years of age) that they do not read a monitor for extended periods of time.

Arranging the Classroom Setting

The physical arrangement of the computers in the classroom can enhance their social use (Haugland & Shade, 1994; Shade, 1994), which also has positive effects on achievement (Clements & Nastasi, 1992). Computers in the classroom, rather than a laboratory, are more likely to facilitate positive social interactions and curriculum integration. Placing two seats in front of the computer and one at the side for the teacher can encourage positive social interaction. Placing computers close to each other can facilitate the sharing of ideas among children. Computers that are centrally located in the classroom invite other children to pause and participate in the computer activity. Such an arrangement also helps keep teacher participation at an optimum level. They are nearby to provide supervision and assistance as needed (Clements, 1991). Other factors, such as the ratio of computers to children, may also influence social behaviors. Less than a 10:1 ratio of children to computers might ideally encourage computer use, cooperation, and equal access to girls and boys (Lipinski et al, 1986; Yost, 1998). Cooperative use of computers raises achievement (Xin, 1999); a mixture of use in pairs and individual work may be ideal (Shade, 1994). It is critical to make sure special education children are accepted and supported. Only in these situations did they like to be included in regular classroom computer work (Xin, 1999).

In summary, we see that children can create complex simulations in second grade (Howland et al, 1997), direct the Logo turtle in preschool, and program in the primary grades, and create pictures and text at all age levels. Will teachers take the time to learn to support such challenging experiences?

Professional Development

If teachers are to take up that challenge, they need substantial professional development. Research has established that less than 10 hours of training can have a negative impact (Ryan, 1993). Further, only 15% reported receiving at least nine hours of training (Coley et al, 1997). Others have emphasized the importance of hands-on experience and warned against brief exposure to a variety of programs, rather than an in-depth knowledge of one (Wright, 1994).

Student teaching may have an adverse effect. Some pre-service teachers' cooperating teachers do not use technology and may actively impede the pre-service teachers' attempts at using technology in the practice of teaching (Bosch, 1993). Teachers at all levels need to be assisted in learning how to integrate computers into instruction (Coley et al, 1997), using models that have proven effective (Ainsa, 1992).

Final Words

The computer can offer unique opportunities for learning through exploration, creative problem-solving, and self-guided instruction. Realizing this potential demands a simultaneous focus on curriculum and technology innovations (Hohmann, 1994). Effectively integrating technology into the curriculum demands effort, time, commitment and sometimes even a change in one's beliefs. One teacher reflected, 'As you work into using the computer in the classroom, you start questioning everything you have done in the past and wonder how you can adapt it to the computer. Then, you start questioning the whole concept of what you originally did' (Dwyer et al, 1991).

Some criticize computer use, arguing that computers, by their nature, are mechanistic and algorithmic and support only uncreative thinking and production. However, adults increasingly view computers as valuable tools of creative production. Educational research indicates that there is no single 'effect' of the computer on mathematics achievement, higher-order thinking and creativity. Technology can support either drill or the highest-order thinking. Research also provides strong evidence that certain computer environments, such as word processing, art and design tools, computer manipulatives, and turtle graphics hold the potential for the computer's facilitation of these educational goals. There is equally strong evidence that the curriculum in which computer programs are embedded, and the teacher who chooses, uses, and infuses these programs, are essential elements in realizing the full potential of technology.

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[2] There are other types of software, and many software titles – some intriguing – that are not discussed here. We report on those for which empirical evidence has been collected. This should not, of course, be taken as a commendation of

software discussed, especially compared to software which has not been studied. The length of our discussion of various types also reflects the size of the research corpus for each.

[3] Perceptual is used here, consistent with Piaget's original formulation, as meaning phenomena or experiences that depend on sensory input, in contrast to those that are represented mentally (and thus can be 're-presented' imagistically without sensory support). Thus, perceptual should not be confused with the notion that we, with Piaget, reject – that of 'immaculate perception' in which perceived objects are immediately registered in the brain.

[4] Mathematization emphasizes representing and elaborating mathematically – creating models of an everyday activity with mathematical objects, such as numbers and shapes; mathematical actions, such as counting or transforming shapes; and their structural relationships. Mathematizing involves reinventing, redescribing, reorganizing, quantifying, structuring, abstracting, and generalizing that which is first understood on an intuitive and informal level in the context of everyday activity.

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Cooperative study teams in mathematics classrooms

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This article describes a general instructional strategy designed to help students in the learning process from textbooks and to furnish opportunities for practice in critical reading. Students participate in cooperative learning by breaking the class up into small groups—the Study Teams—and providing them with worksheets and reading organizers, which organize the material into small items that reflect the major concepts in the reading material on which the study is focused. Some of the benefits that this type of instruction with Study Teams can produce are described.

1. Introduction

As mathematics teachers, we often voice complaints about our students' reluctance to read their mathematics textbooks, or their difficulties solving word problems due to poor reading skills. The typical mathematics student expects a teacher to explain what the book says. He may read a chapter in a history text and answer questions in the book without asking for any explanation; but in mathematics, after the student reads the material the typical response is: 'Fine, I read it. But what does it mean?'

Mathematics is a language that can neither be read nor understood without initiation. Students need to learn how to read mathematics, in the same way they learn how to read a novel or a poem, listen to music, or view a painting. Both a mathematics article and a novel are telling a story and developing complex ideas. The greatest difference is that a mathematical article does the job with a tiny fraction of the words and symbols used in a novel. In reading mathematics each word or symbol is important because there are many thoughts condensed into a few statements.

Mathematics is one area of the curriculum where traditionally, little reading occurs. For a variety of reasons, students do not know how to study mathematics [1]. Most of the time spent deliberately helping students learn to read focuses on literary and historical texts. Mathematical reading (and for that matter, mathematical writing) is rarely expected, much less considered to be an important skill, or one which can be increased by practice and training.

However, in a period of rapid technological change this situation is distressing and dangerous as well. The author believes that the school of the future will have to concentrate more on the relationship between people and knowledge than on knowledge itself. Increased use of information technology has led to an increase in the incidence with which quantitative information is presented in the printed

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